REMARKS/ARGUMENTS

Favorable reconsideration of the present application is respectfully requested.

Claim 1 has been amended to clarify that the fuel and primary combustion air are provided at a location such that heat from the combustion of the fuel contributes to the thermal reduction of the metal oxide. Basis for this is believed to be evident from the specification.

Claims 1-8 have again been rejected under 35 U.S.C. §103 as being obvious over Nishimura et al in view of McDougall et al. Applicants had previously pointed out that the present invention is based on the recognition that a higher oxygen content in the oxidant supplied to the primary burners of a reducing furnace would create a higher flame temperature and NO_x content (see specification, pages 11-12), whereas a lower oxygen concentration in the primary combustion air limits the flame temperature and NO_x produced by the primary burners. Claim 1 therefore recites that the secondary combustion air is oxygen-enriched air, and the oxygen concentration in the primary combustion air is controlled to be lower than the oxygen concentration in the secondary combustion air.

Nishimura et al discloses a rotary hearth furnace. While Nishimura et al recognizes a concern in the prior art for reducing NO_x, it only discloses that the prior art addressed this problem by the addition of secondary air. Nishimura et al further includes burners which add secondary combustion air to burn the generated gas, to reduce fuel consumption.

The primary burners 4 and air feeders 6 in Nishimura et al supply the secondary combustion air to a position where flammable gas is generated during the reduction of the metal oxide in the furnace (col. 5, lined 33-45). Nishimura et al indicates that the primary burners 4 also use air as an oxidizing agent (col. 3, line 14). Nishimura et al thus indicates that both the elements which feed gas for primary combustion and those that feed gas for

secondary combustion may feed air as the gas, so that neither has a higher oxygen concentration.

Moreover, while the description at the top of column 3 of Nishimura et al states that the gas for secondary combustion need not necessarily be air but can instead be "oxygen-rich gas," since air itself is an oxygen-rich gas, lines 1-2 of column 3 in Nishimura et al simply indicate that the secondary combustion gas, if not air, will also have a sufficient concentration of oxygen to combust the generated gas, not that the oxygen concentration of the secondary gas is necessarily greater than that of air.

Indeed, Nishimura et al teaches away from an excessive oxygen concentration for the secondary gas, in view of the risk of reoxidation (column 4, lines 59-61). Thus, to the extent that the "oxygen-rich gas" alternative of Nishimura et al has an oxygen concentration different from air, the oxygen concentration of the secondary gas would be *less than* that of air.

In any case, the prior Office Action recognized that Nishimura et al did not teach that the oxygen concentration in the primary combustion air is controlled to be lower than the oxygen concentration in the secondary combustion air, and the response pointed out that this could not have been taught in McDougall et al since McDougall et al does not disclose a furnace that supplies both a primary and secondary combustion gas.

The "Response to Arguments" portion of the outstanding Office Action indicates that the explanations of the prior response had not been persuasive because there is no quantitative distinction between oxygen rich gas and oxygen enriched air, or so the oxygen enrichment would have been obvious as a result of optimization.

However, even if this description of Nishimura et al were to create a *prima facie* case of obviousness as to the oxygen content of oxygen enriched air, any such *prima facie* case of obviousness is rebutted by the "teaching away" in Nishimura et al. Ordinary air has an

oxygen content of 21% and so "oxygen enriched air" is air which has been enriched to have an oxygen content in excess of 21%. An "oxygen rich" gas is not defined in Nishimura et al and so could be any gas that is "rich" in oxygen. This term, taken in isolation, thus could include an oxygen percentage in excess of 21% but could also include a lower percentage, so long as sufficient oxygen is present.

Thus, the "oxygen rich gas" disclosure of Nishimura et al can be considered to teach a broad range of oxygen content which overlaps the narrower range of the claimed "oxygen enriched air." Such an overlap may be considered to create a *prima facie* case of obviousness. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936-37 (CCPA 1976); MPEP § 2144.05(I). However, any such *prima facie* case of obviousness can be overcome by a showing that the prior art teaches away from the claimed invention in any material respect. *In re Geisler*, 116 F.3d 1465, 43 USPQ2d 1362 (Fed. Cir. 1997); MPEP § 2144.05(III).

In fact, while Nishimura et al teaches the optional use of an "oxygen rich gas" as the secondary gas, it also teaches away from a high oxygen content in the secondary gas because this can cause reoxidation of reduced objects (column 4, lines 59-61). Thus Nishimura et al teaches away from the oxygen content in excess of 21% in oxygen enriched air. This rebuts any *prima facie* case of obviousness that may have been created by an overlap of "oxygen rich gas" and "oxygen enriched air."

In any case, the "Response to Arguments" portion of the outstanding Office Action fails to address the shortcomings of McDougall et al explained in the prior response: McDougall et al could not provide a teaching rendering it obvious to control the oxygen concentration in the primary combustion air of Nishimura et al to be lower than the oxygen concentration in the secondary combustion air, *since McDougall et al does not disclose a furnace that supplies both a primary and secondary combustion gas*.

McDougall et al discloses a reducing furnace which can use powdered coal as a fuel source. It describes that the coal fuel must be of a grade having a certain minimum heat value in order to produce a sufficient flame temperature when using air as an oxidant (col. 3, lines 2-6). While it describes, at lines 11-12 of col. 3, that "if oxygen or oxygen enriched air is employed as the combusting gas even poorer grades of coal can be used as the sole fuel," this relates only to the oxygen content of the primary gas, not to that of a non-existent secondary gas. In any case, this description suggests that the oxygen content of the primary gas should be *high*, to maintain a minimum flame temperature -- the *opposite* of what is claimed.

Concerning the rejection of dependent Claim 9 under 35 U.S.C. §103 as being obvious over Nishimura et al in view of McDougall et al and U.S. patent 4,701,214 (Kaneko et al), it is noted that Kaneko et al was cited to teach features of the dependent claim and fails to provide a teaching for overcoming the shortcomings of Nishimura et al in view of McDougall et al, as noted above. It is therefore respectfully submitted that Claims 1-9 define over this prior art.

Applicants therefore believe that the present application is in a condition for allowance and respectfully solicit an early Notice of Allowability.

Respectfully submitted,

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